estimating at least one respective spatial translation position corresponding to at least one respective symmetry point based on a plurality of the image-dependent correlation function value points bounding the correlation function extremum, the at least one respective spatial translation position indicative of the displacement of the second image relative to the first image,

wherein estimating the spatial translation position corresponding to the at least one respective symmetry point comprises determining the midpoint of at least one line segment having a first endpoint that is one of

a) an image-dependent correlation function value point, and

b) an estimated correlation function value point lying on the correlation function on a first side of the correlation function extremum, and a second endpoint that is one of

a) an image-dependent correlation function value point, and

b) an estimated correlation function value point lying on the correlation function on the a second side of the correlation function extremum.

22. A method for estimating a displacement of a second image acquired by a sensing device relative to a first image acquired by the sensing device, the method comprising:

determining a set of image-dependent correlation function value points indicative of a correlation function extremum, each image-dependent correlation function value point based at least partially on a pattern of image values included in both the first image and the second image, each image-dependent correlation function value point further based on a respective known spatial translation of the image values in the second image relative to the image values in the first image; and

estimating at least one respective spatial translation position corresponding to at least one respective symmetry point based on a plurality of the image-dependent correlation function value points bounding the correlation function extremum, the at least one respective spatial translation position indicative of the displacement of the second image relative to the first image;

wherein estimating the spatial translation position corresponding to the at least one respective symmetry point comprises:

determining a first line including two image-dependent correlation function value points lying on the correlation function on a first side of the correlation function extremum, and

determining a second line having a slope that is approximately the negative of the slope of the first line and that includes an image-dependent correlation function value point lying on the correlation function on a second side of the correlation function extremum and having a correlation function value in a range included within a range whose end points are the correlation function values of the two image-dependent correlation function value points included in the first line, and

~~determining the spatial translation position corresponding to the intersection of the first and second lines~~.

33.   An image-correlation optical position transducer readhead, usable to measure displacement relative to a member having an image-determining surface, the readhead comprising:

a sensing device that receives light reflected from the image-determining surface, the sensing device comprising a plurality of image elements that are sensitive to the reflected light, the plurality of image elements being spaced apart along at least a first direction, the image elements spaced along the first direction at a predetermined spacing, the predetermined spacing usable to determine the spatial translation of an image on the readhead, the spatial translation of the image on the readhead usable to determine the relative displacement of the readhead and the image-determining surface along a predetermined direction,

a light detector interface circuit connected to the sensing device, the light detector interface circuitry outputting signal values from the image elements of the sensing device, the signal values representative of image intensities of the reflected light on those image elements, and

a signal generating and processing circuitry element connected to the light detector interface circuit;

wherein the light reflected from the image-determining surface creates an intensity pattern on the plurality of image elements based on the relative position of the image-determining surface and the readhead;

the light detector interface circuitry outputs a signal value from at least some of the plurality of image elements, the signal values together comprising an image;

the signal generating and processing circuitry element inputs a first image corresponding to a first relative position of the image-determining surface and the readhead and stores a representation of the image;

the signal generating and processing circuitry element inputs a second image corresponding to a second relative position of the image-determining surface and the readhead;

the signal generating and processing circuitry element, based on the first and second images, determines a set of image-dependent correlation function value points indicative of a correlation function extremum; and

the signal generating and processing circuitry element estimates a spatial translation position based on a plurality of image-dependent correlation function value points bounding the correlation function extremum, the spatial translation position representing the displacement of the second image relative to the first image;

wherein at least the image-dependent correlation function value point closest to the extremum is excluded from the plurality of image-dependent correlation function value points bounding the correlation function extremum, such that when estimating the spatial translation position is not based on the image-dependent correlation function value point closest to the extremum.

41.   A speckle-image-correlation optical position transducer readhead, usable to measure displacement relative to a member having an optically diffusing surface, the readhead comprising:

a sensing device that receives the light scattered from a portion of the optically diffusing surface illuminated with coherent light, the sensing device comprising a plurality of image elements that are sensitive to the scattered light, the plurality of image elements being spaced apart along at least a first direction at a predetermined pitch,

a light detector interface circuit connected to the sensing device, the light detector interface circuitry outputting signal values from the image elements of the sensing device, the signal values representative of image intensities of the scattered light on those image elements, and

a signal generating and processing circuitry element connected to the light detector interface circuit;

wherein:

the light detector interface circuitry outputs a signal value from at least some of the plurality of image elements, the signal values together comprising an image;

the signal generating and processing circuitry element inputs a first image corresponding to a first relative position of the optically diffusing surface and the readhead and stores a representation of the image;

the signal generating and processing circuitry element inputs a second image corresponding to a second relative position of the optically diffusing surface and the readhead;

the signal generating and processing circuitry element, based on the first and second images, estimates a first plurality of correlation function value points indicative of a correlation function extremum;

the signal generating and processing circuitry element, based on a set of correlation function value points comprising at least some of the plurality of correlation function value points, estimates a spatial translation position representing the displacement of the second image relative to the first image; and

wherein, for the speckle-image-correlation optical position transducer readhead, the a ratio of the peak-to-peak systematic error which repeats at a period corresponding to one image element pitch to the number of correlation function value points in the set used to determine the spatial translation position is not more than about .02 parts of the image element pitch per correlation function value point, when the peak-to-peak systematic error is expressed as a fraction of the image element pitch.

44. An image-correlation optical position determining system device, usable to estimate a displacement of a second image acquired by a sensing device relative to a first image acquired by the sensing device, the system comprising a signal generating and processing circuitry element that:

determines a set of image-dependent correlation function value points indicative of a correlation function extremum, each image-dependent correlation function value point based at least partially on a pattern of image values included in both the first image and the second image, each image-dependent correlation function value point further based on a respective known spatial translation of the image values in the second image relative to the image values in the first image; and

estimates at least one respective spatial translation position corresponding to at least one respective symmetry point based on a plurality of the image-dependent correlation function value points bounding the correlation function extremum, the at least one respective spatial translation position indicative of the displacement of the second image relative to the first image,

wherein the estimates of the spatial translation position corresponding to the at least one respective symmetry point comprises determining the midpoint of at least one line segment having a first endpoint that is one of

a) an image-dependent correlation function value point, and

b) an estimated correlation function value point lying on the correlation function on a first side of the correlation function extremum, and a second endpoint that is one of

a) an image-dependent correlation function value point, and

b) an estimated correlation function value point lying on the correlation function on the a second side of the correlation function extremum.

46.   An image-correlation optical position determining device, usable to estimate a displacement of a second image acquired by a sensing device relative to a first image acquired by the sensing device, the device comprising:

means for determining a set of image-dependent correlation function value points indicative of a correlation function extremum, each image-dependent correlation function value point based at least partially on a pattern of image values included in both the first image and the second image, each image-dependent correlation function value point further based on a respective known spatial translation of the image values in the second image relative to the image values in the first image; and

means for estimating at least one respective spatial translation position corresponding to at least one respective symmetry point based on a plurality of the image-dependent correlation function value points bounding the correlation function extremum, the at least one respective spatial translation position indicative of the displacement of the second image relative to the first image,

wherein the means for estimating the spatial translation position corresponding to the at least one respective symmetry point comprises means for determining the midpoint of at least one line segment having a first endpoint that is one of

a) an image-dependent correlation function value point, and

b) an estimated correlation function value point lying on the correlation function on a first side of the correlation function extremum, and a second endpoint that is one of

a) an image-dependent correlation function value point, and

b) an estimated correlation function value point lying on the correlation function on the a second side of the correlation function extremum.

50.   An image-correlation optical position determining device, comprising:

a sensing device that receives light and that forms at least a first image based on respective received light and a second image based on respective received light; and

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signal generating and processing circuitry that determines, based on the first and second images formed by the sensing device, a set of image-dependent correlation function value points indicative of a correlation function extremum and that estimates at least one respective spatial translation position corresponding to at least one respective symmetry point based on a plurality of the image-dependent correlation function value points bounding the correlation function extremum, the at least one respective spatial translation position indicative of the a displacement of the second image relative to the first image;

wherein estimating the spatial translation position corresponding to the at least one respective symmetry point comprises:

determining a first line including two image-dependent correlation function value points lying on the correlation function on a first side of the correlation function extremum, and

determining a second line having a slope that is the negative of the slope of the first line and that includes an image-dependent correlation function value point lying on the correlation function on a second side of the correlation function extremum and having a correlation function value in a range included within a range whose end points are the correlation function values of the two image-dependent correlation function value points included in the first line, and

determining the spatial translation position corresponding to the intersection of the first and second lines.

51.   A speckle-image-correlation optical position determining device, comprising:

a sensing device that receives light scattered from a portion of an optically diffusing surface that is movable relative to the sensing device and that is illuminated with coherent light, the sensing device forming at least a first image based on respective received light and a second image based on respective received light; and

signal generating and processing circuitry that estimates, based on the first and second images, a first plurality of correlation function value points indicative of a correlation function extremum and that estimates, based on a set of image-dependent correlation function values comprising at least some of the plurality of image-dependent correlation function value points, at least one respective spatial translation position indicative of the displacement of the second image relative to the first image;

wherein estimating the spatial translation position corresponding to the at least one respective symmetry point comprises:

determining a first line including two image-dependent correlation function value points lying on the correlation function on a first side of the correlation function extremum, and

determining a second line having a slope that is approximately the negative of the slope of the first line and that includes an image-dependent correlation function value point lying on the correlation function on a second side of the correlation function extremum and having a correlation function value in a range included within a range whose end points are the correlation function values of the two image-dependent correlation function value points included in the first line, and

~~determining the spatial translation position corresponding to the intersection of the first and second lines~~.

52.   An information storage medium that stores a program, executable on a processing device, for estimating a displacement of a second image acquired by a sensing device relative to a first image acquired by the sensing device, the program comprising:

instructions for determining a set of image-dependent correlation function value points indicative of a correlation function extremum, each image-dependent correlation function value point based at least partially on a pattern of image values included in both the first image and the second image, each image-dependent correlation function value point further based on a respective known spatial translation of the image values in the second image relative to the image values in the first image; and

instructions for estimating at least one respective spatial translation position corresponding to at least one respective symmetry point based on a plurality of image-dependent correlation function value points bounding the correlation function extremum, the at least one respective spatial translation position indicative of the displacement of the second image relative to the first image,

wherein instructions for estimating the spatial translation position corresponding to the at least one respective symmetry point comprises determining the midpoint of at least one line segment having a first endpoint that is one of

a) an image-dependent correlation function value point, and

b) an estimated correlation function value point lying on the correlation function on a first side of the correlation function extremum, and a second endpoint that is one of

a) an image-dependent correlation function value point, and

b) an estimated correlation function value point lying on the correlation function on ~~the~~ a second side of the correlation function extremum.

54.   An information storage medium that stores a program, executable on a processing device, for estimating a displacement of a second image acquired by a sensing device relative to a first image acquired by the sensing device, the program comprising:

instructions for determining a set of image-dependent correlation function value points indicative of a correlation function extremum, each image-dependent correlation function value point based at least partially on a pattern of image values included in both the first image and the second image, each image-dependent correlation function value point further based on a respective known spatial translation of the image values in the second image relative to the image values in the first image; and

instructions for estimating a spatial translation position based on a plurality of correlation function value points bounding the correlation function extremum, the spatial translation position representing the displacement of the second image relative to the first image;

wherein estimating the spatial translation position corresponding to the at least one respective symmetry point comprises:

determining a first line including ~~two image dependent~~ two image-dependent correlation function value points lying on the correlation function on a first side of the correlation function extremum, and

determining a second line having a slope that is approximately the negative of the slope of the first line and that includes an image-dependent correlation function value point lying on the correlation function on a second side of the correlation function extremum and having a correlation function value in a range included within a range whose end points are the correlation function values of the two image-dependent correlation function value points included in the first line, ~~and~~

~~determining the spatial translation position corresponding to the intersection of the first and second lines.~~